Grain Thresher made from a leaf shredder-wood chipper

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https://sites.google.com/view/low-tech-farm-tools

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A portable, engine driven thresher was made using a leaf shredder/wood chipper or a hammer mill. Small shredders/chippers use 5 to 8 horsepower gas engines that rotate at 2800 or 3600 revolutions per minute (rpm). The modification requires:

- Converting the free-swinging hammers into rasp bars,
- Reducing the rotational speed of the hammers (250 to 1000 rpm on a 12 inch diameter hammer arms), and
- Altering the discharge port to allow smaller, threshed material to pass through a 3/8 to ¾ inch screen while retaining larger materials
- (Optional) if electricity is accessible, the gas engine can be replaced with a ¾ horsepower capacitor start electric motor (1725 rpm).

Materials:

A 5 horsepower, 2800 rpm "Roto-Hoe model 500" leaf shredder/wood chipper is used (Figure 1). Additional parts include:

4 2-inch C clamps (A),
6 5/8 x 3-inch bolts (B),
6 1/8 x 1 inch cotter pins (C),
1 5/8 inch inside diameter x 18-inch drip irrigation tubing or garden hose (D) as spacers between hammers, and
1 8 x 10-inch sheet metal or cardboard (E) to block the slotted portion of the leaf shredder/wood chipper exit port.

Modification:

The "Roto-Hoe" shredder has six sets of three free swinging hammers (F). Convert the six set of hammers into six rasp bars as follows: Cut the 5/8-inch tubing (D) in segments to fit between the free-swinging hammers (F). Tie the free-swinging hammers (F) together by inserting the 5/8-inch bolt (B) into the hole of the first hammer, followed by a segment of tubing (D) as spacer, then another hammer, followed by a second segment of tubing, followed by the third hammer. Locate and drill a 5/32-inch hole on the threaded portion of the bolt that protrudes from the third hammer. Reassemble the bolt, hammers, and spacers together and lock the bolt in place with the cotter pin (C) installed in the 5/32-inch hole. This assembly constitutes a rasp bar. Repeat the above procedure and tie together the remaining five sets of free-swinging hammers. Manually rotate the rasp bars and check for clearance between the rasp bars and the walls of the threshing chamber. If there is insufficient clearance, adjust the bolt position, grind the bolt head, or cut the bolt length to obtain the necessary clearance between the rasp bars and the walls.

The Roto-Hoe shredder exit port (G) consists of a slotted section and a 3/4-inch diameter punched-hole screen. Use the sheet metal or cardboard (E) and C clamps (A) to block the slotted portion of the exit port (G). The threshed grain exits through the 3/4-inch holes.

Start the engine and spin the rasp bars. Again, check for clearance between the rasp bars and the walls of the threshing chamber. If there is a knocking sound, grind the bolt down to obtain the necessary clearance.

Operation:

Start the engine and spin the rasp bars. Dried plant materials with vines, stems, and leaves are fed in batches through the hopper. After threshing for 1 to 3 seconds, open the top door to eject the longer vines, stems, and leaves that have not been chopped up. Seeds and small bits of plant material exit through the punched holes at the bottom. The mixture of seeds and plant material must be separated after threshing.

The 3/4-inch diameter holes in the exit port are suitable for larger seeds (e.g. beans) and seeds with loosely attached husks (e.g. wheat, bok choy, and amaranth). Small seeds and seeds with tight husk or pods (e.g. barley, clover and radish) require smaller diameter exit holes to retain the larger unthreshed materials while passing the smaller threshed grains. This can be achieved by attaching a screen with smaller openings under the 3/4-inch diameter punched holes and the slotted exit.

Larger seeds crack easier than smaller seeds. Reduce the rasp bar speed to decrease the percentage of cracked seeds. Use a larger pulley (H) and/or reduce the engine speed to achieve the desire rasp bar speed:

250-400 rpm	for beans and large seeds
400-800 rpm	coriander, radish, sunflower
600-1400 rpm	wheat, oats, barley, rice and small seeds

Typical threshing rates are:

Seeds	Pounds of seeds per hour,
Amaranth	66
Bok Choy	22 to 30
Oats	94
Pinto bean	117
Soy bean	81 to 127

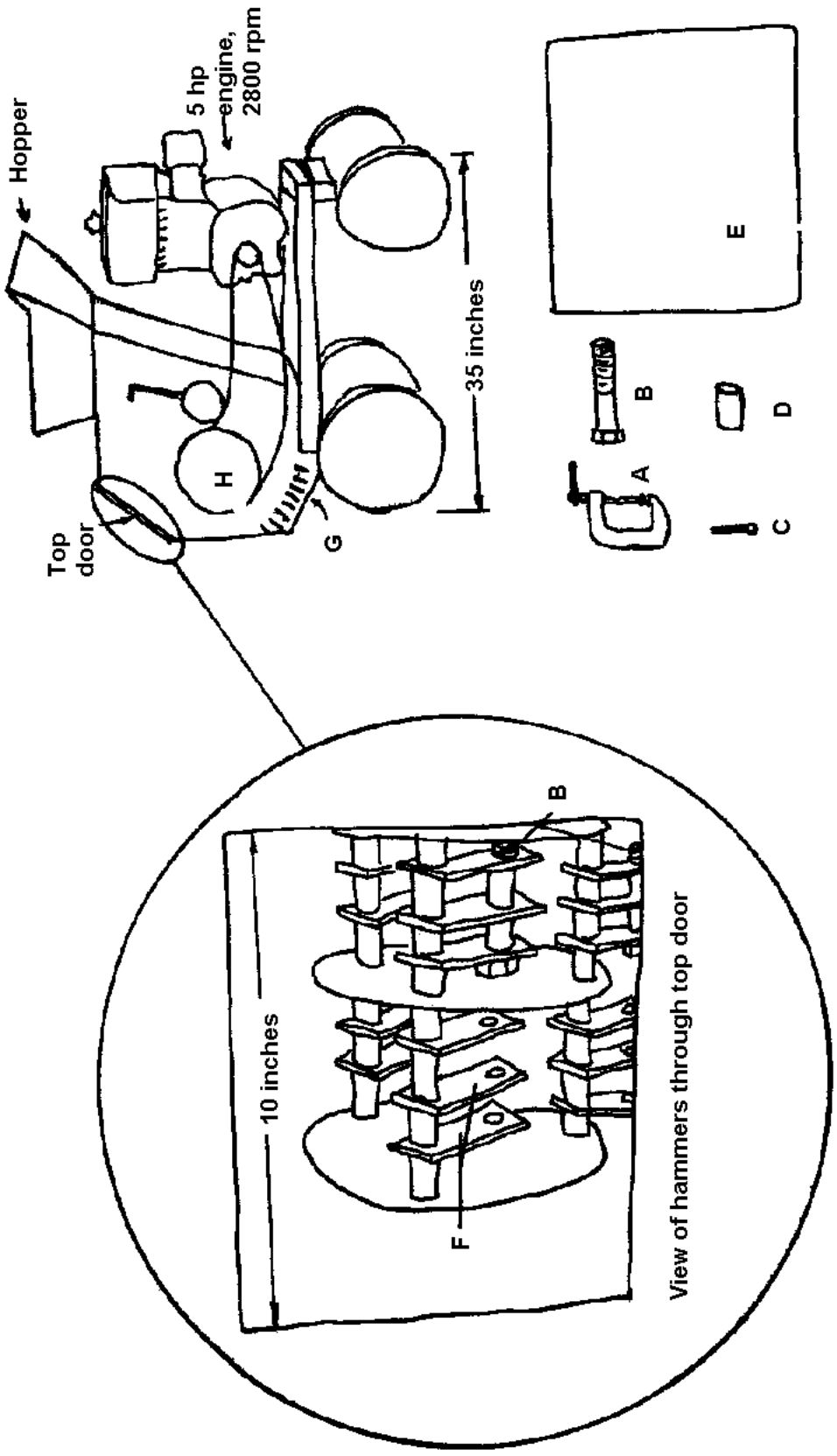

Figure 1. Grain thresher from a leaf shredder

Alternative to rpm adjustments to minimize cracked seeds

The slotted section of the exit port (G) consists of 8 metal flat bars (1/8 x 1 ½ x 11 inch) in concave arrangement (Figure 2 and 3); 7 removable bars and 1 welded in place. Grains are dislodged from the seed head by impacting on the concave bars. With fewer concave bars in the threshing chamber the number of impacts on the seed for each drum revolution is reduced, thereby reduce seed cracking. For large seeds, try using 1 or 2 concave bar and remove the remaining 6 or 7 concave bars. Attach a ¾ inch wire mesh screen under the slotted section of the concave after removing the concave bar. For small seeds, leave all 8 concave bars in place. For medium sized seeds, use intermediate number of concave bars.

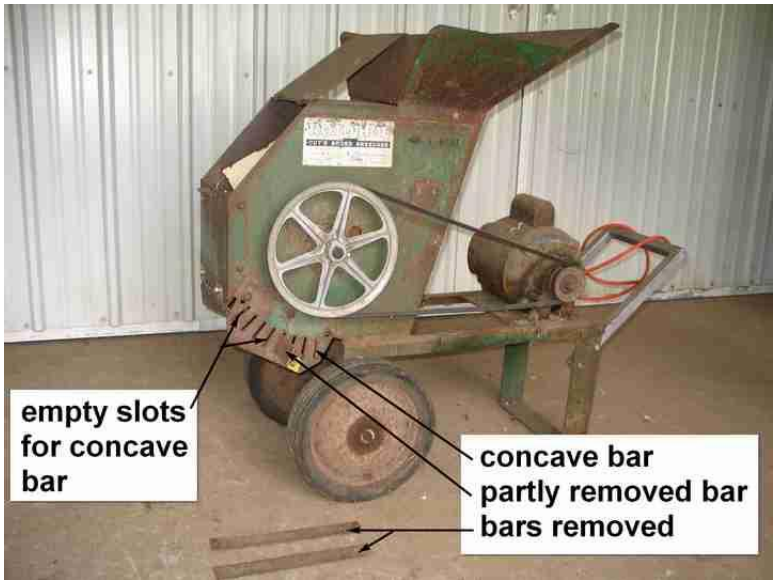

Figure 2. Converted Roto Hoe grain thresher with a ¾ hp electric motor, 3-inch drive sheave, 10-inch hammer sheave, and concave bars.

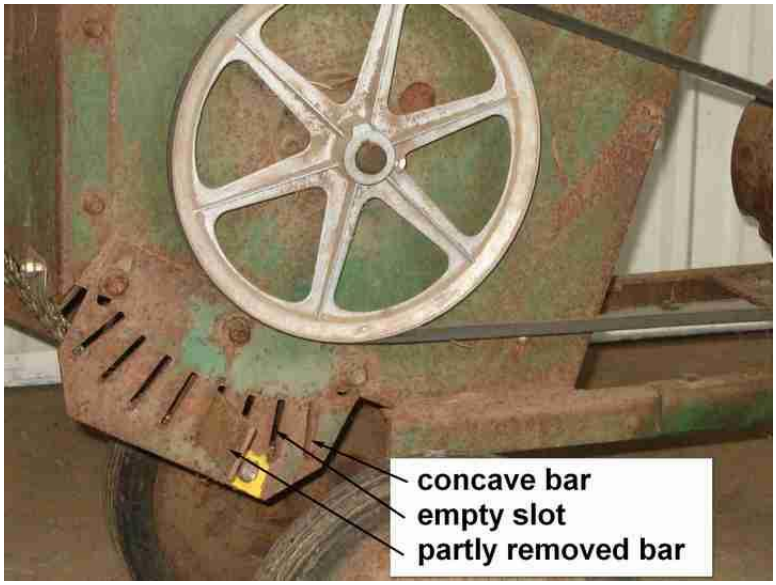

Figure 3. Close-up of concave bar, partly removed bar and empty slots.

Modification of a hammer mill (Figure 4) into a grain thresher (Figure 5 and 6) is similar to those made for the leaf shredder/wood chipper:

- modify the fix mounted hammers into free rotating hammers and rasp bars.
- make suitable screens to retain larger materials while allowing smaller materials to pass through the screen. The original hammer mill had a screen with ¼ inch opening. For beans and grains use a screen with ½ to ¾ inch opening.
- modify the discharge port to allow grains and chaff exit at the bottom of the hammer mill.
- adapt the belt drive to rotate the hammers at 50 to 500 revolutions per minute.

Figure 4. Original hammer mill

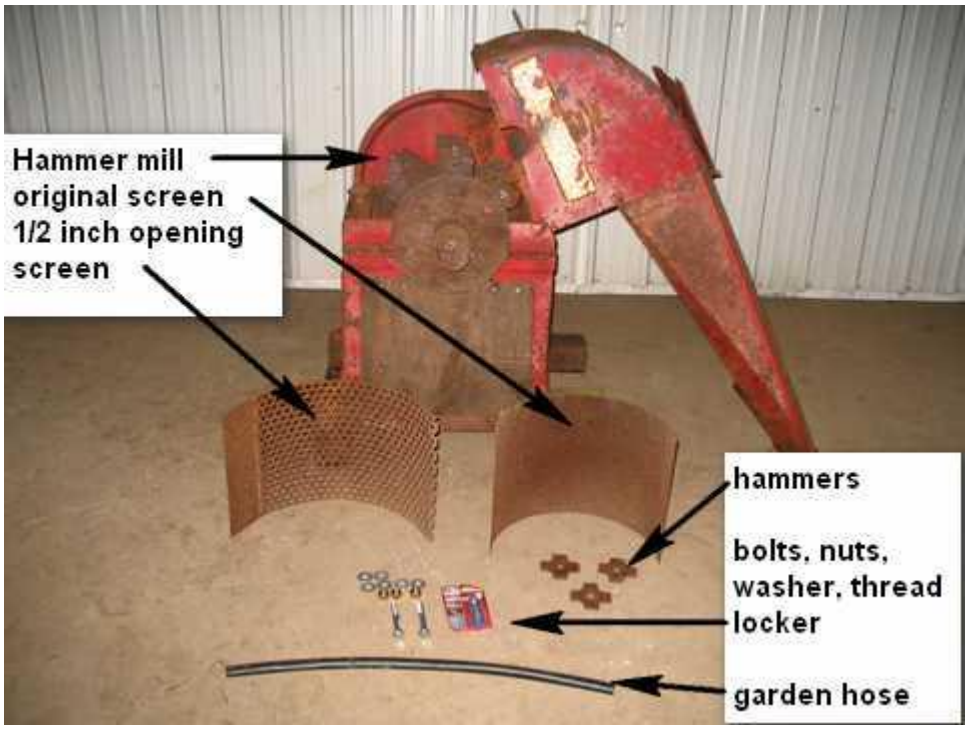

Figure 5. Hammer mill with hammers exposed, original screen, modified screen for threshing beans, and parts to convert a hammer mill to grain thresher. Thread locker (e.g. Loctite 271 Threadlocker or equivalent) retains nuts on bolts; garden hose used as spacer.

Original fix-mounted hammers
Free rotating hammers mounted on 5/8 inch bolts with washer and spacer
Hammers, partly installed on 5/8 inch bolt

Figure 6. Close-up of original fix-mounted hammers, converted free rotating hammers and partly installed hammers. Thick wall rubber hose or tubing, used as spacers, absorbs more impact resulting in less splitting of large seeds. Thin wall hose dislodges small grains from seed head more efficiently. The bolt, hammer and hose assembly function as a rasp bar.